Project Code and Title

B.02.01.03.02 Anatomic Neck Model

Project Objective

Develop a finite element model of the human neck with sufficient anatomic detail to investigate both bony and soft tissue injuries under automotive crash loads. Types of injuries to be investigated include flexion, extension, compression, tension, lateral bending, and torsion. Long-term objectives are to utilize this model in the development of neck injury criteria.

Background

Analytical modeling, in combination with experimental testing, will provide essential information on the mechanisms and tolerances of neck injuries.

Problem Definition

Understanding the complex problem of neck injuries is difficult using only experimental methods. A detailed finite element model will be used in combination with experimental testing to provide needed insight into the mechanisms and tolerances of neck injuries.

Research Approach

A detailed finite element model of the human neck will be developed, including sufficient anatomic detail to investigate both bony and soft tissue injuries under automotive crash loads. This model will be validated against experimental data available in the literature and from related experimental studies. The validated model will then be used to study applications of interest to the automotive safety community.

Potential Impact/Application

All crashworthiness programs involving neck injury mechanisms and tolerances.

Project Manager(s)

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Project Tasks

Task	Title and Description
Task 1	Run simulations corresponding to experimental tests conducted at Duke University and the Medical College of Wisconsin. Predicted injuries will be correlated with documented pathology from the tests. This will provide the first level of validation for the finite element model.
Task 2	Modify and improve model to better represent the human response to tension and extension. Add full body representation to model.
Task 3	Run simulations of rear impact interaction with seat back and head restraint. Full body model will be required to properly simulate seat back interaction. Evaluate the effect of head restraint positioning on the loads and moments resulting in the neck.
Task 4	Run simulations of airbag interaction in ISO position 1 and position 2. Torso representation will be required to properly simulate airbag reaction against the chest and under the chin. Compare results with experimental dummy tests conducted at VRTC.
Task 5	Add musculature to the model and check response against human volunteer data. This will provide a second level of validation for the model.

Task	Start Date	Projected Completion Date	Status/Responsibility
1	1/97	9/97	
2	1/97	9/97	
3	9/97	3/98	
4	9/97	6/98	
5	9/97	9/98	